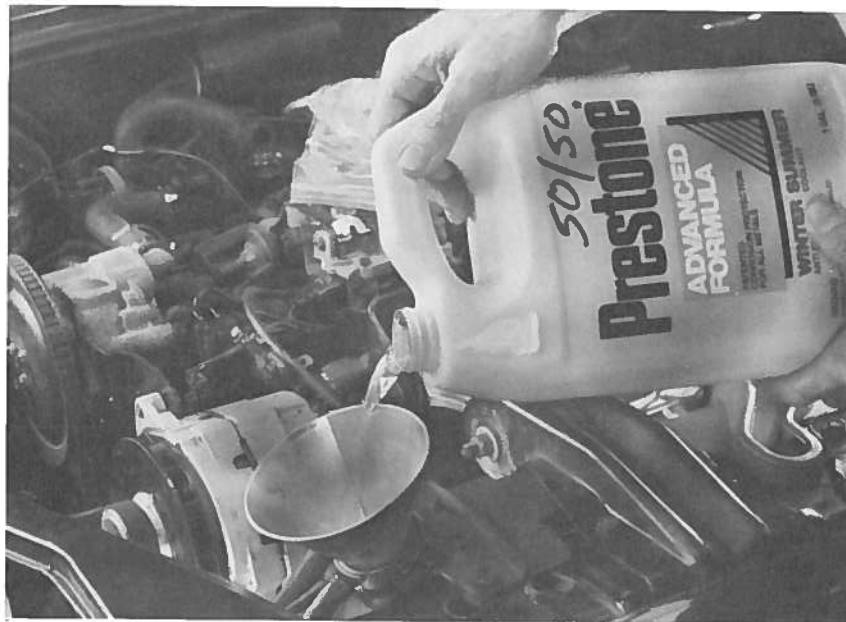


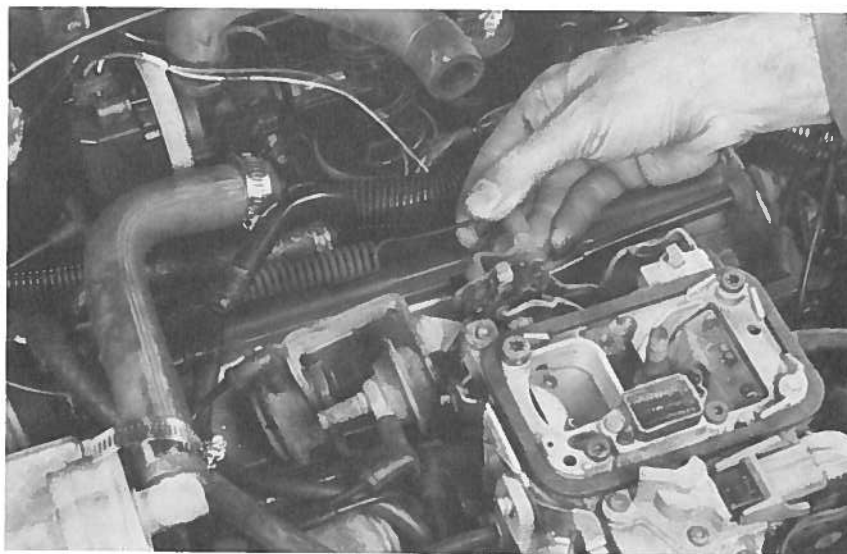
When you're confident that the wiring is correctly connected to the proper components, you can connect the negative battery terminal to the battery. As you're doing this, keep your eyes and ears open. If you see (or smell) any smoke or hear a sharp, cracking noise from the engine as you're connecting the terminal, immediately remove the terminal from the battery. Find out where the smoke or noise is coming from and correct it before trying to reconnect the battery.

With the battery connected, you should be ready to prepare for starting the engine.



Fill the radiator with a 50/50 mix of water and coolant. For greater protection, you can use up to 15% more coolant in

the mixture, but never use less than 50% coolant.



Before starting the engine, make sure that the throttle return spring is con-

nected and that the throttle closes fully. Don't start the engine until it does!

Break-In

8

Introduction

You've spent numerous hours painstakingly cleaning, assembling, and installing your engine. Your excitement begins to build and you can't wait to start it. This is definitely the time for the pay-off pitch, but don't rush now. If you do, you stand a good

chance of shortening your engine's life or worse. Instead, discipline yourself to work slowly and methodically. This will help prevent mistakes.

Before you start the engine, make sure all belts and hoses are securely connected. Check all the electrical connections to ensure they're

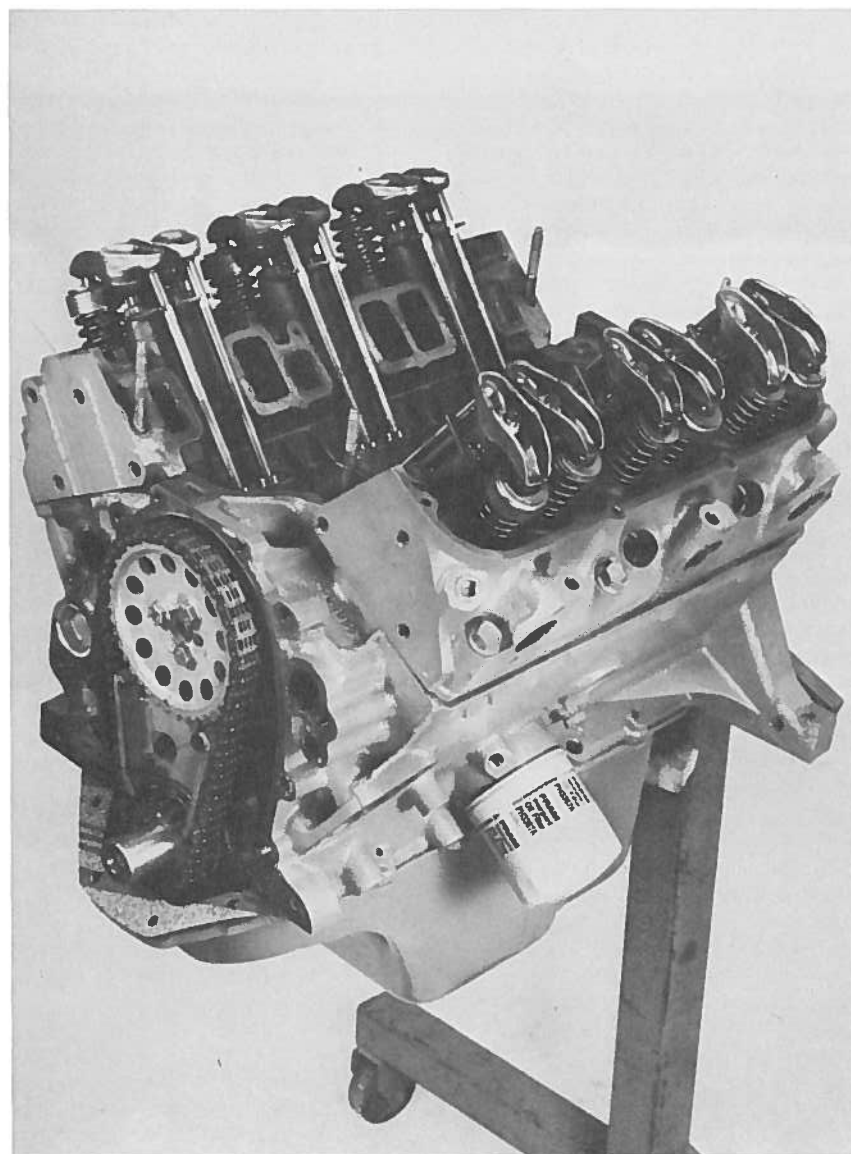
where they belong and aren't hanging where they can be caught by a spinning belt or be burned. Check the coolant and oil levels, and be sure there's enough fuel in the fuel tank to start the engine and run it for at least forty-five minutes. This is very important, because once you start the engine it needs to be run at 2000-4000rpm for thirty minutes to help break in the camshaft and lifters properly, preventing them from dying a quick, merciless death.

If you haven't already, prime the engine. For more information, refer to "Priming the Lubrication System" in Chapter 6. This prelubes the engine, preventing metal-to-metal contact and premature wear. Also, connect a mechanical oil pressure gauge so that you have an immediate and accurate idea of oil pressure. To install this gauge, remove the oil pressure switch on the side of the block and screw the gauge fitting into the hole. Route the gauge tubing away from anything sharp or hot, such as the exhaust system, and position the gauge so that it can easily be read. Oil pressure should rise to 55-70psi at 2000rpm if the outdoor temperature is around 70degF.

If oil pressure doesn't build, assume that the oil filter is plugged and replace it. Even if you've used a new oil filter it can still be plugged. Replace the filter and check for oil pressure once again while cranking the engine.

The last item to check is fuel flow. The cranking of the engine should have allowed the fuel pump to prime the fuel lines and carburetor. To check fuel flow, quickly open the throttle and watch for a stream of gas to flow into each carburetor venturi. On a carbureted engine, pour about half-an-ounce of gas down the carburetor just before starting the engine to prime it.

If the engine is equipped with any type of fuel injection system, all you need to do to prime the system is to turn the ignition key to the "RUN" position. You should hear the electric fuel pump in the tank run for a few



All the time and care you've expended during the assembly process can be for

naught if you don't break in the engine properly.

seconds and then shut off. If you don't hear it run, check the fuel pump fuse in the fuse block.

One last thing. Have your assistant start your car so that you can watch what's happening in the engine compartment. And keep a fire extinguisher handy—just in case the need arises.

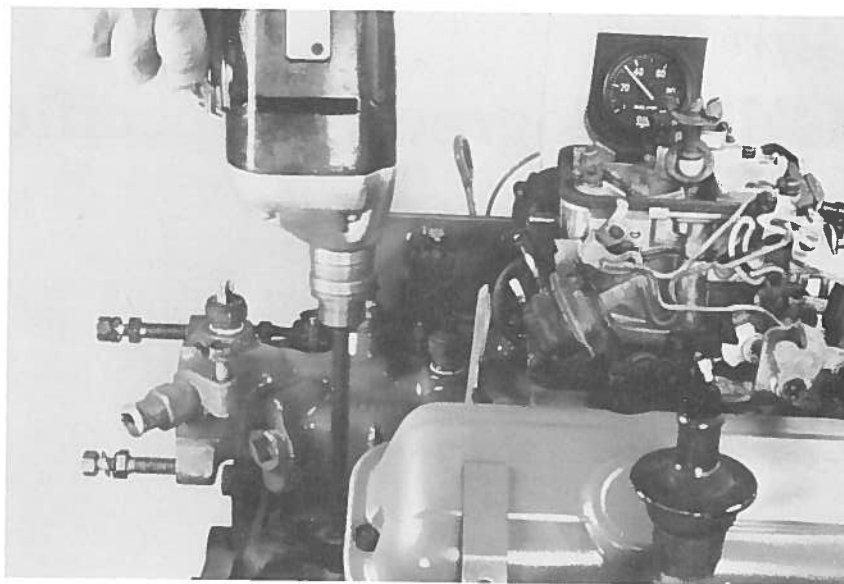
Starting Your Newly Rebuilt Engine

Now that you've got the engine in and everything connected, you want to jump in and fire it up. That's understandable, but you need to keep your emotions in check for at least a few minutes more. This will give you time to double-check your work to ensure that the engine truly is ready to come to life once again. If you have any friends left after borrowing their tools, garage, or whatever, ask one to watch for any "surprises" that may occur when the engine starts running, such as a gas line or oil leak or a radiator cooling fan that isn't working.

It's best to have the exhaust system connected and fully operational before you start the engine, as this will allow you to listen for any unusual noises as the engine starts and runs. You also must check the operation of the throttle. It must return to the fully closed position, or you may have a V-6 hand grenade in the engine compartment rather than an engine. If the throttle doesn't fully close, the cable may be kinked or the return springs may be missing from the lever or not attached to the engine.

As your friend tries to start the engine, be ready at the distributor. If the engine doesn't start in about 3sec or so, and if it doesn't sound like it will, stop cranking the engine. This will save wear and tear on the cam and lifters if they're new. Then put your hand around the middle of the distributor cap, halfway between the spark plug wires and metal housing, rotate the distributor a few degrees, and have your friend try again. If it coughs and sputters, try rotating the distributor in that direction until it starts.

If it doesn't sound like it's going to start, try turning the distributor in the opposite direction. If it still doesn't start, stop cranking and check the position of the distributor cap rotor. It should line up with the #1 spark plug wire terminal in the distributor cap



Prime the engine to prevent excessive wear during engine start-up.

when the piston in cylinder #1 is at TDC. If it's within 1/4in or so, just rotate the distributor until it aligns. If it's farther away than this, you'll have to remove the distributor and rotate its shaft until you get a satisfactory alignment. If the engine still won't start, you may have installed the distributor 180deg out of position. Check for this by following the procedure outlined in the "Distributor/Oil Pump Drive" section of Chapter 6.

As soon as the engine starts, run it at 2000–4000rpm. Engine oil pressure should be at least 40psi with 10W30 in the crank-case. If it isn't, stop the engine immediately. Unfortunately, if the oil pressure is this low and all the galley plugs are in, the oil pump is bad or there is excessive bearing clearance. If you don't have a tachometer, run the engine at an extra-high idle as this should be about 2000rpm. As you're running the engine, be sure to raise and lower the rpm between 2000 and 4000 to vary the loading of the engine components. This ensures a proper break in.

After the engine is started, it may smoke. A moderate amount of smoke can be expected if the engine has been freshly painted, because the enamel smokes as it's cured by engine heat. An engine will also smoke if oil has spilled on the exhaust system or if the exhaust system is new. This is normal and no cause for alarm, but if

the smoke lasts more than five minutes, or it's in tremendous volume, something is probably wrong. Stop the engine immediately and find the cause of the problem.

Strange and/or unusual noises are another concern. Clicking noises in the area of the valve covers can signal a valvetrain problem—typically, loose rocker arms. However, the fuel injectors in an MPFI engine make a clicking noise as they open and close. Don't mistake this noise for a valvetrain problem.

As the engine runs, have your friend keep an eye on the coolant temperature gauge, oil pressure gauge, and tachometer. Engine temperature shouldn't rise above 220degF. If it does, place an electric fan in front of the radiator to provide additional cooling. If the engine temperature still rises, shut the engine off. When the engine has cooled, carefully check the coolant level and for any leaks that may have caused the elevated temperature.

The First Oil Change

After the engine has been run 25min or so, you'll need to change the engine oil filter. That's because the moly-lube you used on the camshaft, lifters, and other internal parts will completely plug an oil filter in about 30min of engine operation.

Appendix

GM 60-Degree V-6 Specifications

General & Component Specifications

	2.8L V6	3.1L V6
Bore x Stroke	3.503inX2.992in (89mmX76mm)	3.503inX3.312in (89mmX84mm)
Firing Order	1-2-3-4-5-6	1-2-3-4-5-6
Bearing Clearances		
Main	0.0015-0.0025in (0.038-0.064mm)	0.0015-0.0025in (0.038-0.064mm)
Rod	0.0011-0.0025in (0.028-0.064mm)	0.0011-0.0025in (0.028-0.064mm)
Connecting Rod Side Clearance	0.008-0.020in (0.20-0.51mm)	0.008-0.020in (0.20-0.51mm)
Camshaft		
Lift		
Intake	0.231in (5.86mm)	NOT USED
Exhaust	0.262in (6.65mm)	NOT USED
<i>Note: Cam above used on early base 2.8L V6's & some S10's & Camaros</i>		
Intake	0.262in (6.65mm)	0.262in (6.65mm)
Exhaust	0.273in (6.94mm)	0.273in (6.94mm)
Journal Clearance	0.001-0.0025in (0.026-0.063mm)	0.001-0.0025in (0.026-0.063mm)
Crankshaft Main Journals		
Small journal		NOT USED
#1, #2 & #4 Journals	2.4937-2.4946in (63.340-63.364mm)	NOT USED
#3 Journal	2.4932-2.4941in (63.327-63.351mm)	NOT USED
Large Journal	2.647-2.648in (67.241-67.265mm)	2.647-2.648in (67.241-67.265mm)
Taper (maximum)	0.0002in (0.005mm)	0.0002in (0.005mm)
Out-Of-Round (maximum)	0.0002in (0.005mm)	0.0002in (0.005mm)
Crankshaft Rod Journals		
Small Journal		
Large Journal	1.998-1.999in (50.758-50.784mm)	1.998-1.999in (50.758-50.784mm)
Taper (maximum)	0.0002in (0.005mm)	0.0002in (0.005mm)
Out-Of-Round (maximum)	0.0002in (0.005mm)	0.0002in (0.005mm)
Crankshaft End Play	0.0024-0.0083in (0.06-0.21mm)	0.0024-0.0083in (0.06-0.21mm)
Cylinder Bore		
Diameter	3.503-3.506in (88.992-89.070mm)	3.5046-3.5053in (89.016-89.034)
Taper (maximum)	0.0008in (0.020mm)	0.0008in (0.020mm)
Out-Of-Round (maximum)	0.0008in (0.020mm)	0.0008in (0.020mm)
Piston-To-Bore Clearance	0.0007-0.0017in (0.017-0.043mm)	0.0009-0.0022in (0.0235-0.0565)
Oil Pressure (Engine @ Normal Operating Temp) 30-55psi @ 2000rpm (205-380kPa @ 2000rpm)		
Piston Ring End Gap Clearance		
Top Compression	0.010-0.020in (0.25-0.50mm)	0.010-0.020in (0.25-0.50mm)
Second Compression	0.010-0.020in (0.25-0.50mm)	0.010-0.020in (0.25-0.50mm)
Oil Rails	0.011-0.030in (0.27-0.75mm)	0.010-0.030in (0.25-0.75mm)
Piston Ring Side Clearance		
Top Compression	0.0012-0.0027in (0.030-0.070mm)	0.002-0.0035in (0.05-0.09mm)
Second Compression	0.0016-0.0037in (0.040-0.095mm)	0.002-0.0035in (0.05-0.09mm)
Oil (maximum)	0.008in (0.200mm)	0.008in (0.200mm)
Rocker Arm Ratio	1.50:1	1.50:1
Valve Stem Clearance	0.001-0.0027in (0.026-0.068mm)	0.0016-0.0025in (0.041-0.064mm)
Valve Spring Pressure		
Cast Iron Heads		
Valve Open	195lbs @ 1.18in (867Nm @ 30mm)	189lbs @ 1.20in (841Nm @ 30.5mm)
Valve Closed	88lbs @ 1.575in (391Nm @ 40mm)	80lbs @ 1.575in (356Nm @ 40mm)
Aluminum Heads		
Valve Open	215lbs @ 1.291 (956Nm @ 33mm)	
Valve Closed	90lbs @ 1.701 (400Nm @ 43mm)	